FORM PTO-1390 (Modified) (REV 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: APV31535

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR): 10/018061

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/AU00/00669	June 16, 2000 ✓	June 18, 1999 ✓

TITLE OF INVENTION: **CATHODE PLATE** ✓

APPLICANT(S) FOR DO/EO/US: **David BAILEY**; **Reville Wayne ARMSTRONG**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include itens (5), (6), (9) and (24) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☐ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

Notice of Claim for Priority
PCT Request
Copy of the International Application as filed

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/018061	PCT/AU00/00669	APV31535

24. The following fees are submitted:	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :		
☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**		
☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**		
☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**		
☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**		
☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	**$890.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$0.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	14 - 20 =	0	x $18.00	**$0.00**	
Independent claims	2 - 3 =	0	x $84.00	**$0.00**	
Multiple Dependent Claims **(check if applicable).**			☐	**$0.00**	
TOTAL OF ABOVE CALCULATIONS =				**$890.00**	
☐ Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				**$0.00**	
SUBTOTAL =				**$890.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +				**$0.00**	
TOTAL NATIONAL FEE =				**$890.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).** ☐				**$0.00**	
TOTAL FEES ENCLOSED =				**$890.00**	
				Amount to be: refunded	$
				charged	$

a. ☒ A check in the amount of **$890.00** to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **19-4375** A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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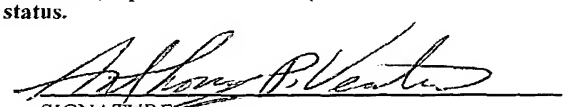
PATENT & TRADEMARK OFFICE



SIGNATURE

Anthony P. Venturino
NAME

31,674
REGISTRATION NUMBER

~~PLEASE GRANT ANY EXTENSION OF TIME~~ ~~AND/OR PETITIONS~~ FOR THE PTO TO EXTEND THE TIME FOR RESPONSE AS REQUIRED TO MAKE THE ATTACHED DOCUMENT TIMELY FILED. ~~PLEASE CHARGE THE COST THEREOF~~ TO DEPOSIT ACCOUNT 19-4375

STEVEN DAVIS MILLER & MOSHER, L.L.P.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application

David BAILEY et al

Serial No.: To be assigned (National Phase of PCT/AU00/00669 filed June 16, 2000)

Filed: December 14, 2001

For: CATHODE PLATE

PRELIMINARY AMENDMENT

Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

Prior to the calculation of the filing fee, please amend the above-identified application as follows:

IN THE ABSTRACT

After the last page of claims, insert on a new page the Abstract shown on the attached sheet (ATTACHMENT I).

IN THE CLAIMS

Please amend the claims as follows. A copy of the claims marked up to show the amendments is attached (Attachment II).

3. (Amended) A method as claimed in claim 1 wherein the sides of the groove are between 75 and 150° apart.

4. (Amended) A method as claimed in claim 1 wherein the sides of the groove are 90° apart.

5. (Amended) A method as claimed in claim 1 wherein the groove is shaped to allow deposition of metal directly adjacent the apex of the groove.

6. (Amended) A method as claimed in claim 1 wherein the groove is shaped to permit deposited metal to substantially fill the entire groove.

7. (Amended) A method as claimed in claim 1 wherein the groove is shaped to capture gas rising from below the cathode plate during deposition of metal.

10. (Amended) A cathode plate as claimed in claim 8 wherein the sides of the groove are between 75 and 150° apart.

11. (Amended) A cathode plate as claimed in claim 8 wherein the sides of the groove are 90° apart.

12. (Amended) A cathode plate as claimed claim 8 wherein the groove is shaped to allow deposition of metal directly adjacent the apex of the groove.

13. (Amended) A cathode plate as claimed claim 8 wherein the groove is shaped to permit deposited metal to substantially fill the entire groove.

14. (Amended) A cathode plate as claimed in claim 8 wherein the groove is shaped to capture gas rising from below the cathode plate during deposition of metal.

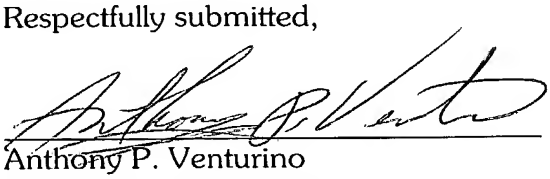
Please cancel claims 15 and 16.

REMARKS

The claims have been amended to delete the multiple dependent claim status and cancel claims 15 and 16. No new matter is presented by the above amendments. Early and favorable consideration of this application is respectfully requested.

Respectfully submitted,

Date: Dec. 14, 2001

By: 

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ATTACHMENT I

ABSTRACT

A method of electro-depositing an envelope of metal on a cathode. The metal envelope (120) comprises metal sheets (122, 124) on either side of the cathode plate (100). A groove (150) is provided along one edge of the cathode plate whereby metal deposited on and adjacent to the groove forms a frangible portion (140). The groove is shaped such that a line of weakness (A) is formed in the metal deposited within the groove such that separation of the two sheets of deposited metal is initiated along the line of weakness.

ATTACHMENT II - Marked up Claims

CLAIMS

1. A method of electro-depositing an envelope of metal on a cathode said envelope including deposited metal on either side of said cathode joined along at least one edge by a frangible portion, and being removable from said cathode by rotation of respective sides of the deposited metal envelope about the frangible portion to separate the deposited metal from the cathode into two substantially equivalent sheets,

the method comprising providing a groove on said cathode plate whereby metal deposited on and adjacent to said groove forms said frangible portion,

and wherein said groove is shaped such that a line of weakness is formed in the metal deposited within the groove such that separation of the two sheets of deposited metal is initiated along said line of weakness.

2. A method as claimed in claim 1 wherein the groove is shaped as a V, the line of weakness being formed within the arc of the V.

3. A method as claimed in claim 1 [or claim 2] wherein the sides of the groove are between 75 and 150° apart.

4. A method as claimed in [any one of the preceding claims] wherein the sides of the groove are 90° apart.

5. A method as claimed in [any one of the preceding claims] wherein the groove is shaped to allow deposition of metal directly adjacent the apex of the groove.

6. A method as claimed in [any one of the preceding claims] wherein the groove is shaped to permit deposited metal to substantially fill the entire groove.

7. A method as claimed in [any one of the preceding claims] wherein the groove is shaped to capture gas rising from below the cathode plate during deposition of metal.

8. A cathode plate for electro-deposition of an envelope of metal, said cathode plate having a groove along at least one edge and shaped such that, in use, a line of weakness is formed in the metal deposited within the groove,

whereby during stripping of metal from said cathode, separation of the envelope of metal into two substantially equivalent sheets is initiated along said line of weakness.

9. A cathode plate as claimed in claim 8 wherein the groove is shaped as a V, the line of weakness being formed within the arc of the V.

10. A cathode plate as claimed in claim 8 ~~or claim 9~~ wherein the sides of the groove are between 75 and 150° apart.

11. A cathode plate as claimed in ~~any one of claims 8 to 10~~ claim 8 wherein the sides of the groove are 90° apart.

12. A cathode plate as claimed in ~~any one of claims 8 to 11~~ claim 8 wherein the groove is shaped to allow deposition of metal directly adjacent the apex of the groove.

13. A cathode plate as claimed in ~~any one of claims 8 to 12~~ claim 8 wherein the groove is shaped to permit deposited metal to substantially fill the entire groove.

14. A cathode plate as claimed in ~~any one of claims 8 to 13~~ claim 8 wherein the groove is shaped to capture gas rising from below the cathode plate during deposition of metal.

~~15. A method of electro-depositing an envelope of metal on a cathode substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.~~

~~16. A cathode plate for electro-deposition of an envelope of metal substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.~~

TITLE: **CATHODE PLATE**

TECHNICAL FIELD

The present invention relates to a cathode plate for use in electro-deposition of metal.

BACKGROUND ART

There are various processes and apparatus for electro-refining or electro-winning metal.

One particularly successful process for electro-depositing of copper for example is the so-called ISA PROCESS in which copper is deposited on a stainless steel cathode mother plate. The electrolytically deposited copper is then stripped from the cathode by first flexing the cathode to cause at least a part of the copper deposit to separate from the cathode and then wedge stripping or gas blasting the remainder of the copper from the cathode.

In the ISA PROCESS the bottom edge of the cathode mother plate is generally covered with a release compound such as wax or a plastic edge strip to prevent deposition of copper thereon. This allows for removal of the electro-deposited copper as substantially equivalent separate sheets from both sides of the cathode plate. Such waxing of the cathode sheet, however, is time consuming and there is added cost both for applying the wax and for recovering the wax from the stripping process and associated housekeeping.

To avoid these difficulties, some electro-refining/electro-winning operations use a so-called enveloped cathode process. In such a process the lower edge of the cathode

sheet is not waxed and the electro-deposited metal is allowed to grow on both sides of the sheet and around the bottom edge of the cathode mother plate.

Removal of the electrolytically deposited envelope of metal is then accomplished by flexing the cathode and pulling back the metal from both sides of the sheet so that it forms a V. The cathode mother plate is then removed from between the electrolytically deposited envelope of metal, the envelope is then closed and rotated from its vertical position to a horizontal position and transported to a stacking/bundling station.

Not only does such a removal process require complex apparatus for opening the metal envelope, removing the cathode mother plate prior to closing of the envelope and rotating the envelope from the vertical to the horizontal position for stacking, such an arrangement is time consuming and generally not as quick as the ISA PROCESS stripping step.

In conjunction with other parties, the applicant has recently developed a new process in which an envelope of metal is formed on the stainless steel cathode mother plate and then stripped into two separate sheets. This process is subject of co-pending International Patent Application No. PCT/FI99/00979. By way of summary, the new process will be discussed with reference to figures 1A-1D and 2A-2D attached herewith.

The initial step in stripping an electrolytically deposited metal envelope from its cathode mother sheet is to at least partially separate either side of the deposited envelope from the cathode sheet. In this regard reference is made to figures 1A-1D. The enveloped cathode comprises cathode sheets 20 and 30 deposited on the cathode mother sheet 10 and joined along the lower edge thereof by a frangible portion 40. The cathode

mother sheet is firstly flexed to provide separation of at least the upper end portion 50 of the sheets 20, 30.

The partially separated envelope as shown if figure 1D is then subjected to a stripping operation as shown in figures 2A and 2B. The partially separated sheets 20 and 30 are positioned in a stripping apparatus on rollers or conveyor belt 50. The apparatus includes a wedge stripper or air blaster 130. These wedge strippers 130 enter the gap between sheets 20, 30 and cathode mother sheet 10. The wedge strippers 130 release the sheets 20 and 30 of the electro-deposited envelope from the cathode mother sheet 10. The sheets 20 and 30, however, are still held together by the frangible portion 40 extending along the bottom edge of the cathode sheet 10 as shown in Figure 2B. To effect full separation of the electro-deposited metal envelope into separate substantially equivalent sheets. These sheets are 20 and 30 is held by grippers 25, 35 and rotated about the frangible portion 40 from the substantial vertical position shown in figure 2B to the substantially horizontal position shown in figure 2C. This rotation separates the deposited metal into two substantially equivalent sheets. In many cases, a single rotation of the sheets 20, 30 from the vertical to the horizontal is all that is required to separate the sheets. This separation of the sheets 20 and 30 from each other as well as the cathode mother plate may be confirmed by the grippers 25, 35 as follows. The grippers which still hold the sheet 20, 30 in the horizontal position shown in figure 2C, are adapted to pull the respective sheets slightly outward as shown in figure 2D. If the sheets, 20, 30 move outwardly in unison with the grippers, separation of the sheets 20, 30 is confirmed. If, however, the force to move the grippers outward is too great or simply the grippers do not move this indicates that the frangible portion 40 has not in

fact separated the sheets 20, 30 and accordingly further rotation (as shown in figure 2C) of the sheets may be required.

If further manipulation/rotation of sheets 20, 30 is required, the apparatus using grippers 25 and 35 rotates sheets 20 and 30 upwardly and downwardly until the aforementioned confirmation of separation of the sheets is effected.

Once the cathode sheets 20 and 30 are separated into substantially equivalent separate sheets, it is a simple matter to transport the sheets out of the apparatus for stacking and subsequent treatment.

In some cases it is quite difficult to separate the envelope of deposited metal into two separate sheets. As will be appreciated, repeated rotation or flapping of the sheet portions can be quite time consuming and reduces the overall efficiency of the process.

Reference is made to Figure 3 which shows a groove 15 in a cathode mother plate 10 with deposited metal extending around the end of the cathode mother plate 10. This groove 15 is formed in the bottom edge of the cathode mother plate as a 'growth effecting means' as described in co-pending International Patent Application No. PCT/FI99/00979. The Applicant's have found, however, that even with groove 15 the deposited metal may not cleanly release from the cathode plate or split into two substantially equivalent sheets 20, 30. To explain, as shown in Figure 3, on occasion, the metal envelope separates into two sheets with a lip 25 attached to one sheet. This lip extends around almost the entire end portion of the mother plate 10. The fracture line 35 between metal sheets 20 and 30 is essentially on one side of the cathode mother plate 10 rather than being in the preferred frangible region 40 at the lower end of the mother plate.

It is an object of the present invention to overcome or ameliorate at least one of the disadvantages of the prior art, or to provide a useful alternative to the prior art.

DISCLOSURE OF THE INVENTION

In a first aspect, the present invention provides a method of electro-depositing an envelope of metal on a cathode said envelope including deposited metal on either side of said cathode and joined along at least one edge by a frangible portion, and being removable from said cathode by rotation of respective sides of the deposited metal envelope about the frangible portion to separate the deposited metal from the cathode into two substantially equivalent sheets,

the method comprising providing a groove on said cathode plate whereby metal deposited on and adjacent to said groove forms said frangible portion,

and wherein said groove is shaped such that a line of weakness is formed in the metal deposited within the groove such that separation of the two sheets of the deposited metal is initiated along said line of weakness.

In a first embodiment, the groove is shaped as a V, with the line of weakness being formed within the arc of the V.

In another embodiment the arc of the V-groove is between 75 and 105 degrees and most preferably the arc of the V-groove is substantially 90 degrees.

The present applicant has determined that the size and shape of the groove in the cathode mother plate has an impact on the ability to separate the deposited metal envelope from the cathode into two substantially equivalent sheets.

By appropriate sizing and shaping of the groove, it is possible to reliably provide a line of weakness between the two sides of the electro-deposited envelope, such that the

separation or splitting of two separate sides of sheets of the deposited metal envelope is initiated on the line of weakness within the groove.

If the line of weakness is not formed within the groove, the fracture line may be initiated outside the confines of the groove and in some cases may continue to propagate round the end of the plate to an exterior side of the cathode mother plate metal envelope as shown in Figure 3. The sheets may then fracture at a point outside the frangible region. Having such a line of fracture outside the frangible region creates difficulties in the stripping process. Firstly, it can render splitting of the two sheets quite difficult. In some instances it may be necessary to rotate or flap the sheets several times to provide separation. Clearly this is undesirable, and increases the residence time of the plate in the stripping machine and thereby slows production.

Further, having a line of fracture outside the frangible region will produce two sheets which are not substantially symmetrical or equivalent in size. One sheet may be essentially flat with another sheet having a small lip or hooked edge as shown in Figure 3. The resulting sheets with uneven edges are unsightly and difficult to handle particularly in high speed automated machinery.

The applicant has found that the size and shape of the groove can be tailored so that the line of weakness extending between the two sheets remains within the confines of the groove. The shape of the groove is a balance between allowing growth of the deposited metal in the groove while still permitting easy separation of the two sheets.

Indeed, in another embodiment the groove may be shaped to permit deposited metal to substantially fill the entire groove. In yet another embodiment, the groove is shaped to allow deposition of metal directly adjacent the apex of the groove.

In another aspect, the present invention provides a cathode plate for electro-deposition of metal, said cathode plate having a groove along at least one edge and shaped such that, in use, a line of weakness is formed in the metal deposited within the groove,

whereby during stripping of metal from said cathode, separation of the envelope of metal into two substantially equivalent sheets is initiated along said line of weakness.

Unless the context clearly requires otherwise, throughout the description and the claims, the words 'comprise', 'comprising', and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figures 1A-2D are end elevational views of the process for stripping electro-deposited metal envelopes as developed by the applicant and are included for clarification purposes only.

Figure 3 is an end elevational view of a cathode mother plate with a deposited metal envelope partially stripped into two separate sheets,

Figure 4 is an end elevational view of an embodiment of the present invention,

Figures 5 and 6 are end elevational views showing different shaped bottom edges of cathode plates.

MODE(S) FOR CARRYING OUT THE INVENTION

Figures 1A-2D and Figure 3 all relates to prior art mechanisms and are discussed above.

The applicants have found that it is possible to tailor a groove in the lower end of the mother plate such that a line of weakness is formed in the groove to thereby permit reliable fracture of the deposited metal envelope into two substantially equivalent and preferably symmetrical sheets.

Reference is made to Figure 4 which shows cathode mother plate 100 with a V-groove 150 formed along its lower end edge. For the sake of simplicity, the arc of groove 150 shown in Figure 4 is 90 degrees, however, as will be appreciated from the foregoing it is not essential that the groove by V-shaped or that the arc of the groove equal 90 degrees.

The shape and size of V-groove 150 is designed to perform several functions. Its primary function is to permit separation of the deposited metal envelope 120 from the mother plate 100 into two substantially equivalent sheets 122 and 124.

How the V-groove provides this function will now be explained. As will be clear to persons skilled in the art, when the mother plate 100 is placed in an electrolytic cell for, say, electro-refining of copper, it is interspersed between copper anodes and substantially immersed in an electrolytic solution. The copper from the anodes enters the electrolyte for redepositing on the cathode. Generally, to provide a "full term" deposit the cathode remains in the electrolyte bath for between 5 and 14 days.

When the copper crystals are deposited on the metal cathode, they are deposited at substantially right angles to the deposition surface. This is shown by arrows in Figure 4. Generally, the copper will take the path of least resistance and endeavour to deposit on

the cathode as quickly as possible. Accordingly, it will be appreciated that it is easier for the copper to deposit on the exterior side surfaces 102, 104 of the cathode plate 100 rather than in the V-groove 150. It is important, however, that copper is deposited in the V-groove since when the copper envelope is removed from mother plate 100, by pulling on the opposite sides of the metal envelope as discussed above, fracture or crack initiation begins in the frangible region 140 at the lower end of the mother plate 100. It is desirable that this crack initiation begins at the apex of V-groove 150. Accordingly, it is preferable that V-groove 150 is shaped to allow deposition of copper in the V-groove adjacent the apex with the line of weakness extending between the arc of the V-groove 150.

The applicants have found that certain groove sizes and shapes permit such 'symmetrical' splitting of the deposited metal while others do not. For instance, a V-groove with an arc of 90° ± 15° allows growth of copper in the V-groove while providing a line of weakness as shown by dotted line A between the arc of the V-groove. When the deposited metal envelope is then removed, the position of line of weakness A in the V-groove causes the splitting of the deposited metal into two substantially equivalent sheets to initiate along the line of weakness or fracture line in the frangible region 140.

The groove 150 shown in Figure 4 can be compared with the V-groove shown in the Figures 5 and 6.

In Figure 5, a shallow V-groove 60 is shown. The shape of this V-groove 60 does not provide as great a resistance to deposition of copper as does groove 150 shown in Figure 4. Accordingly, copper is deposited quite readily in V-groove 60. This is

desirable. However. the applicants have found that due to the shape of groove 60, the length and hence effectiveness of the line of weakness is reduced. Thus a stronger bond is formed between the two sides of the metal envelope making it more difficult to split the metal envelope into two substantially equivalent sheets. Indeed, experimental trials have shown that several cycles of rotation or flapping in the stripping machine may be required to separate such sheets and in some cases they may split in a manner similar to that shown in Figure 3.

In Figure 6, the groove 70 is narrower and deeper. This creates a greater resistance to deposition of copper ions that enter V-groove 150 of Figure 4 or V-groove 60 of Figure 5. In some cases, copper will not deposit throughout V-groove 70 and particularly not near the apex of the V-groove. This causes a bridging 80 of metal across the V-groove. This bridging of metal across the V-groove avoids formation of the line of weakness in the arc of the V-groove. The bridge 80 can act to strongly bind the two sides of the metal envelope which, once again, may result in the deposited metal requiring several cycles of rotation or flapping to separate into two sheets which, most likely, will not be substantially equivalent in size.

In another embodiment of the present invention, which is particularly suitable for electro winning processes, the V-groove can be sized and shaped to trap gaseous material which further acts to define a line of weakness in the arc of the groove.

It will be appreciated that variations may be made to the process and apparatus described herein without departing from the spirit or scope of the present invention.

CLAIMS

1. A method of electro-depositing an envelope of metal on a cathode said envelope including deposited metal on either side of said cathode joined along at least one edge by a frangible portion, and being removable from said cathode by rotation of respective sides of the deposited metal envelope about the frangible portion to separate the deposited metal from the cathode into two substantially equivalent sheets,

the method comprising providing a groove on said cathode plate whereby metal deposited on and adjacent to said groove forms said frangible portion,

and wherein said groove is shaped such that a line of weakness is formed in the metal deposited within the groove such that separation of the two sheets of deposited metal is initiated along said line of weakness.

2. A method as claimed in claim 1 wherein the groove is shaped as a V, the line of weakness being formed within the arc of the V.

3. A method as claimed in claim 1 or claim 2 wherein the sides of the groove are between 75 and 150° apart.

4. A method as claimed in any one of the preceding claims wherein the sides of the groove are 90° apart.

5. A method as claimed in any one of the preceding claims wherein the groove is shaped to allow deposition of metal directly adjacent the apex of the groove.

6. A method as claimed in any one of the preceding claims wherein the groove is shaped to permit deposited metal to substantially fill the entire groove.

7. A method as claimed in any one of the preceding claims wherein the groove is shaped to capture gas rising from below the cathode plate during deposition of metal.

8. A cathode plate for electro-deposition of an envelope of metal, said cathode plate having a groove along at least one edge and shaped such that, in use, a line of weakness is formed in the metal deposited within the groove,

whereby during stripping of metal from said cathode, separation of the envelope of metal into two substantially equivalent sheets is initiated along said line of weakness.

9. A cathode plate as claimed in claim 8 wherein the groove is shaped as a V, the line of weakness being formed within the arc of the V.

10. A cathode plate as claimed in claim 8 or claim 9 wherein the sides of the groove are between 75 and 150° apart.

11. A cathode plate as claimed in any one of claims 8 to 10 wherein the sides of the groove are 90° apart.

12. A cathode plate as claimed in any one of claims 8 to 11 wherein the groove is shaped to allow deposition of metal directly adjacent the apex of the groove.

13. A cathode plate as claimed in any one of claims 8 to 12 wherein the groove is shaped to permit deposited metal to substantially fill the entire groove.

14. A cathode plate as claimed in any one of claims 8 to 13 wherein the groove is shaped to capture gas rising from below the cathode plate during deposition of metal.

15. A method of electro-depositing an envelope of metal on a cathode substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

16. A cathode plate for electro-deposition of an envelope of metal substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 December 2000 (28.12.2000)

PCT

(10) International Publication Number
WO 00/79028 A1

(51) International Patent Classification[7]: C25C 7/08, 7/02, 1/12

(21) International Application Number: PCT/AU00/00669

(22) International Filing Date: 16 June 2000 (16.06.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PQ 1066 18 June 1999 (18.06.1999) AU

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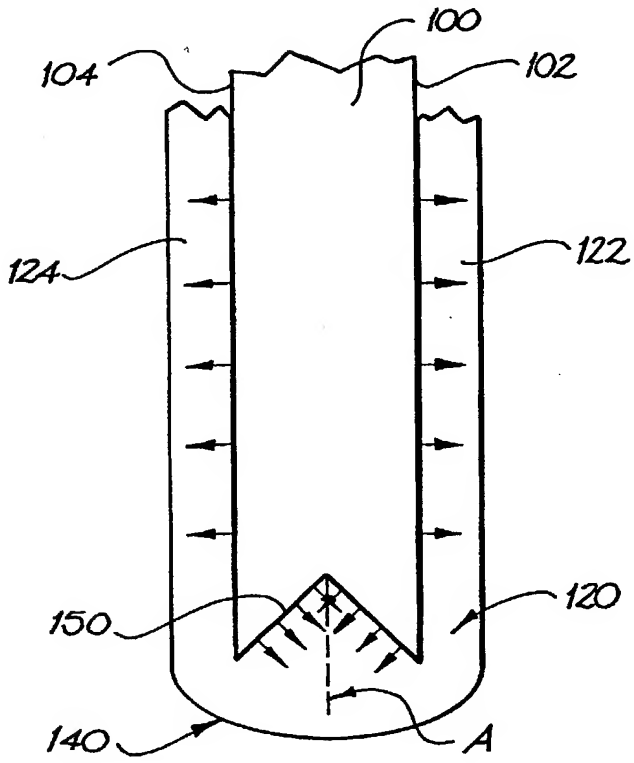
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: CATHODE PLATE



(57) Abstract: A method of electro-depositing an envelope of metal on a cathode. The metal envelope (120) comprises metal sheets (122, 124) on either side of the cathode plate (100). A groove (150) is provided along one edge of the cathode plate whereby metal deposited on and adjacent to said groove forms a frangible portion (140). The groove is shaped such that a line of weakness (A) is formed in the metal deposited within the groove such that separation of the two sheets of deposited metal is initiated along the line of weakness.

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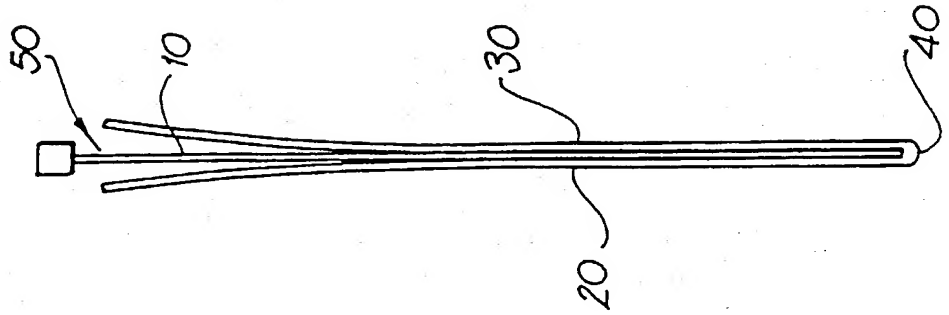

FIG. 1D
PRIOR ART

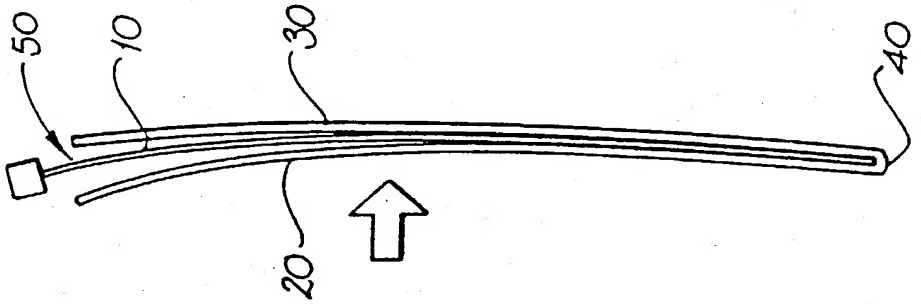

FIG. 1C
PRIOR ART

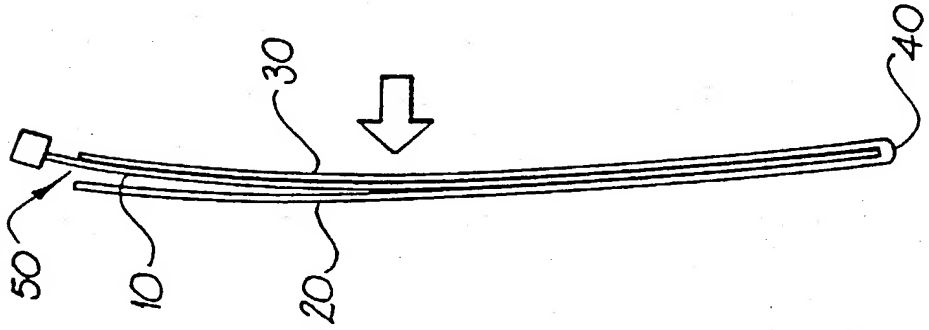

FIG. 1B
PRIOR ART

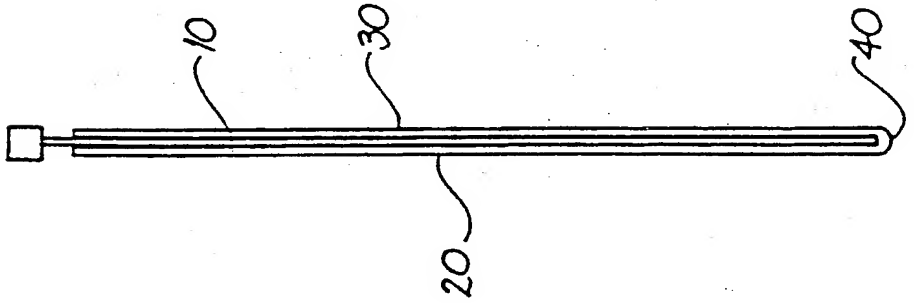

FIG. 1A
PRIOR ART

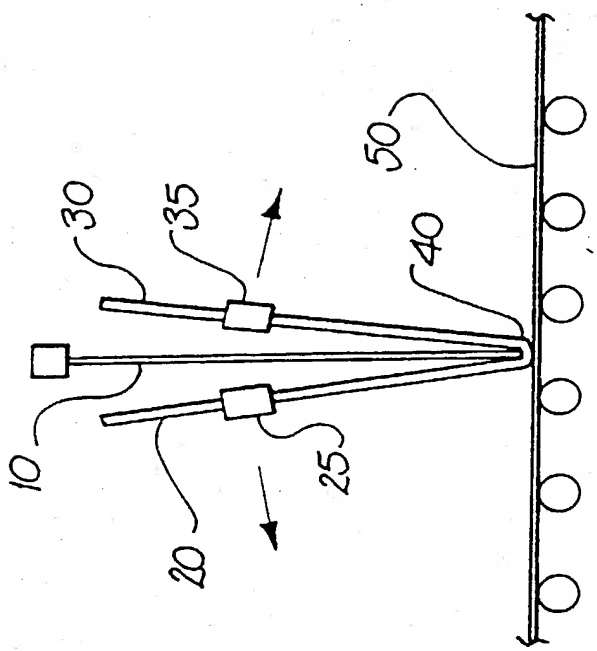

FIG. 2B
PRIOR ART

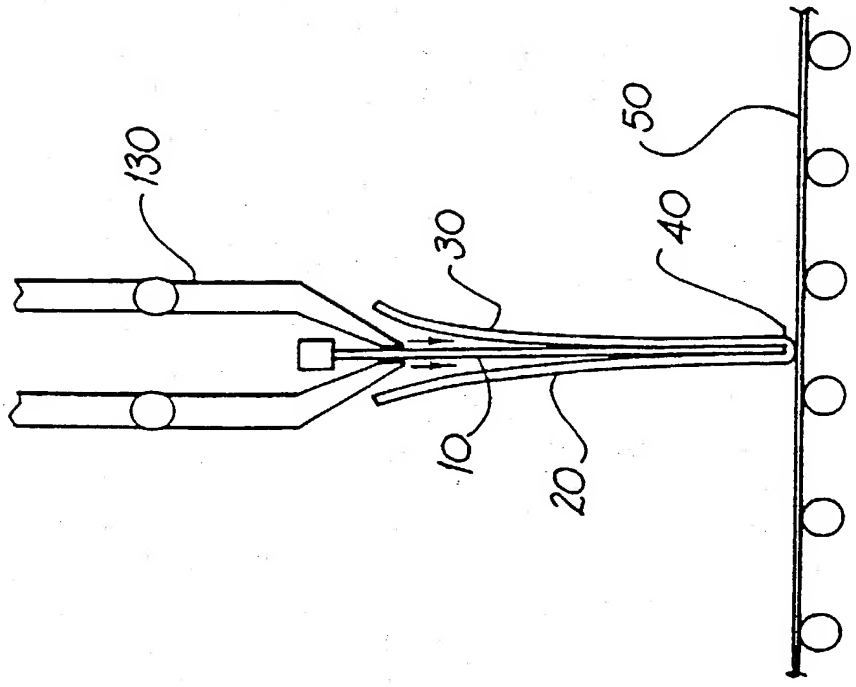

FIG. 2A
PRIOR ART

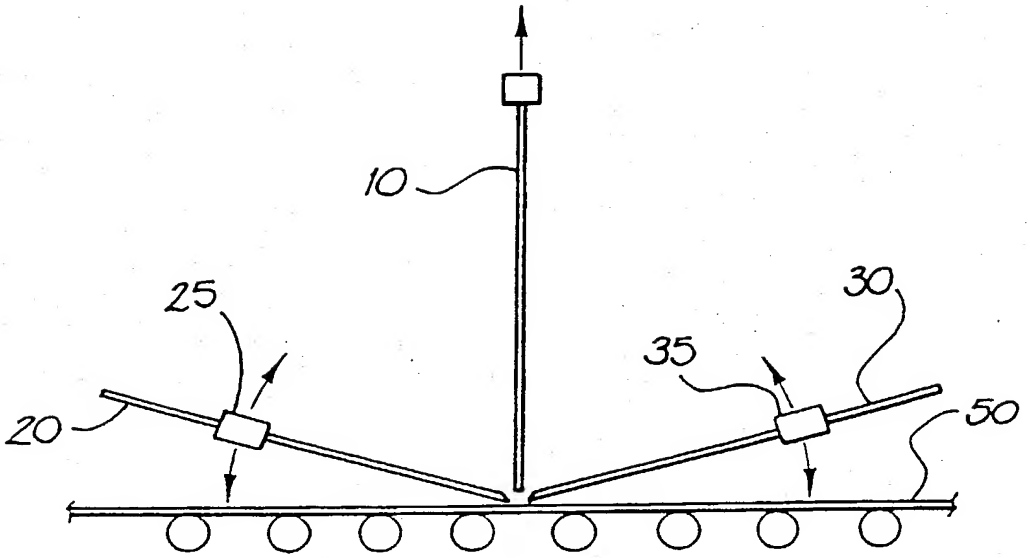

FIG. 2C
PRIOR ART

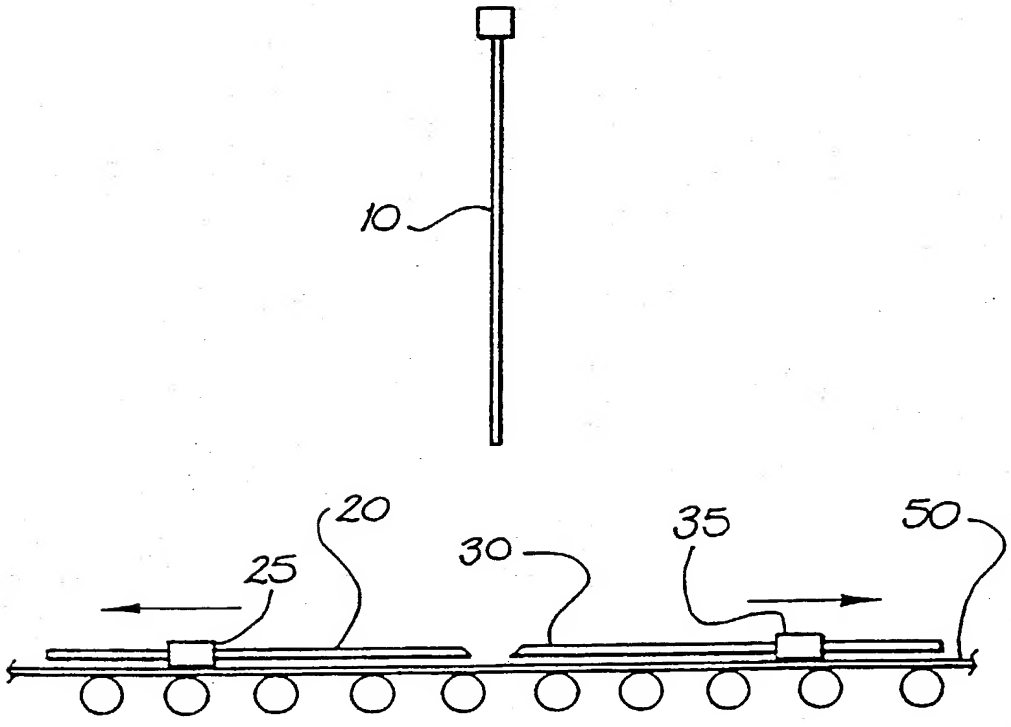

FIG. 2D
PRIOR ART

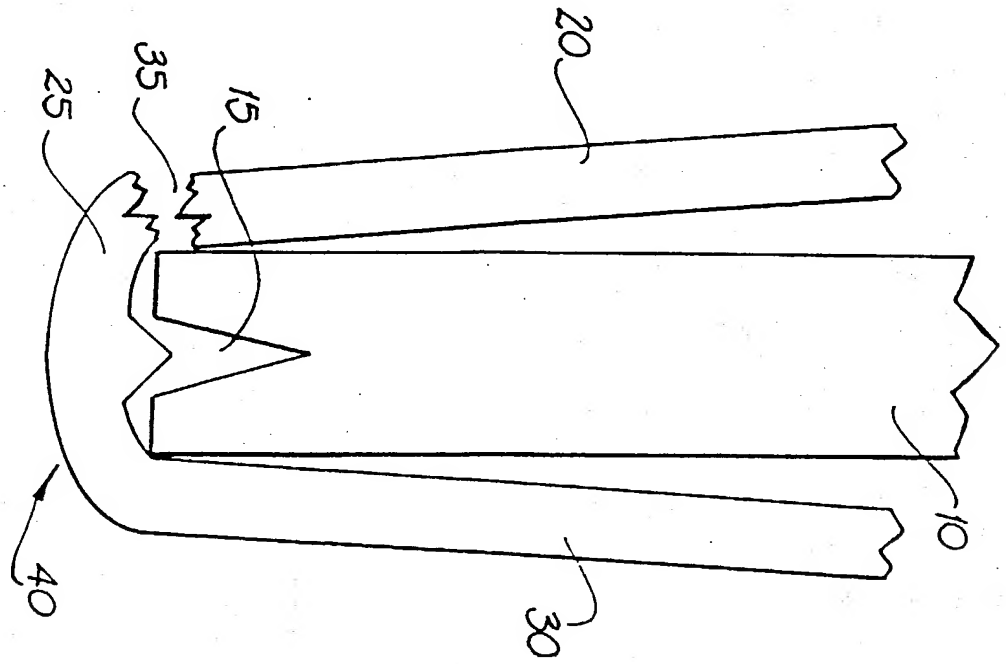

FIG. 3
PRIOR ART

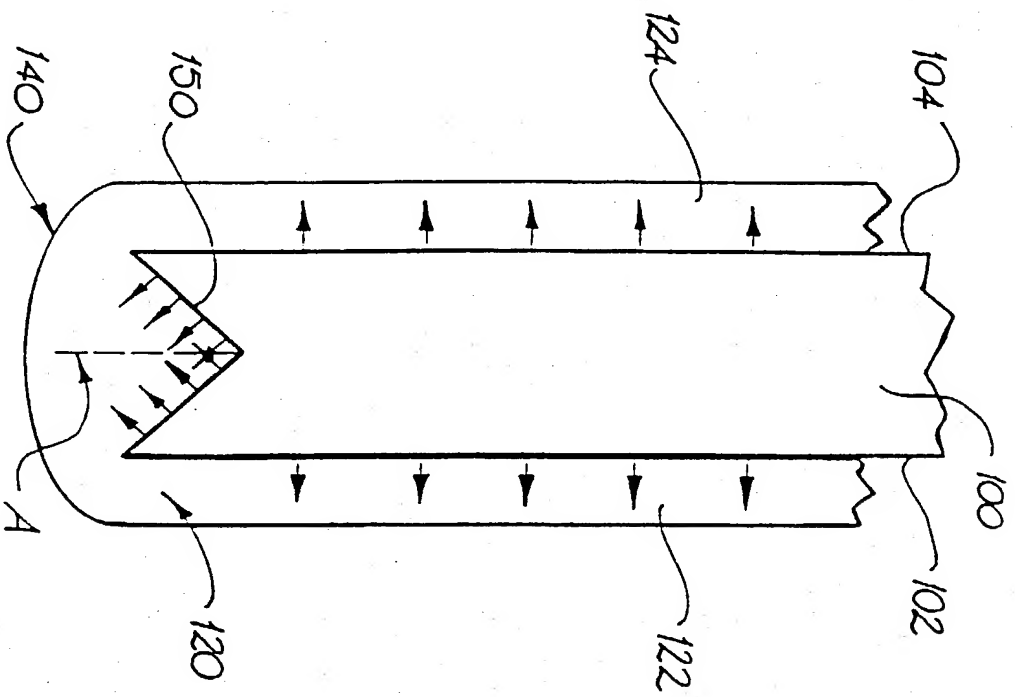

FIG. 4

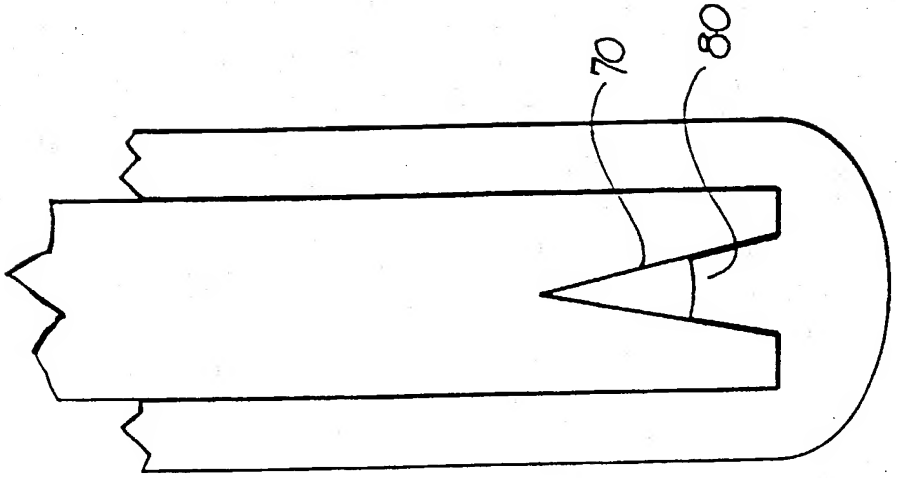

FIG. 6

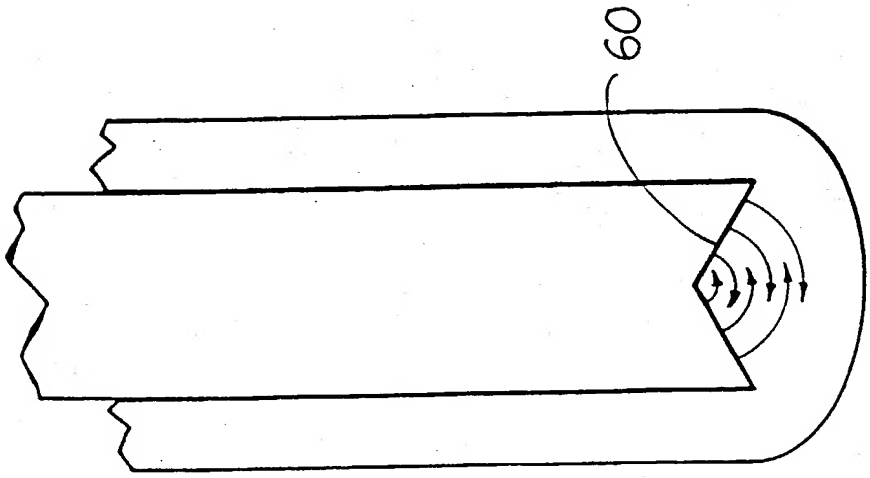

FIG. 5

COMBINED DECLARATION AND POWER OF ATTORNEY FOR UTILITY PATENT APPLICATION (Includes PCT)	Attorney Docket No. APV31535

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name; that
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

CATHODE PLATE

the specification of which (check one)
[ ] is attached hereto.

[ ] was filed on ____ as Application Serial No. ____ and was amended on N/A. (if applicable)

[X] was filed as PCT International Application No. PCT/AU00/00669 on June 16, 2000, and was filed in the U.S. National Stage on December 14, 2001 as U.S. Patent Application No.10/018,061.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I do not know and do not believe the claimed invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application.

I hereby claim foreign priority benefits under Title 35, United States Code §119 and/or §365(a)(b) of any foreign application(s) and United States provisional applications for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application(s) on which priority is claimed:

Prior Foreign and U.S. Provisional Application(s)			Priority Claimed	
PQ 1066	AU	18/06/99	[X]	[ ]
(Number)	(Country)	Day/Month/Year Filed	Yes	No
			[ ]	[ ]
(Number)	(Country)	Day/Month/Year Filed	Yes	No

Attorney Docket No. APV31535

I hereby claim the benefit under Title 35, United States Code, §120 and/or §365(c) of any United States application(s) or PCT international application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Application Serial No.	Filing Date	Status (patented, pending, abandoned)
Application Serial No.	Filing Date	Status (patented, pending, abandoned)

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith; Stevens, Davis, Miller & Mosher, L.L.P.; Anthony P. Venturino, Reg. No. 31,674; James E. Ledbetter, Reg. No. 28,732; and Thomas P. Pavelko, Reg. No. 31,689. Direct all telephone calls to telephone no. 202-785-0100 and faxes to 202-408-5200.

Address all correspondence to 1615 L Street, N.W., Suite 850, Washington, D.C. 20036.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Residence:		**Citizenship**
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